## CSCI 340 - Homework 2

## Dr. Schwartz

1. If the only difference between $L$ and $L^{*}$ is the word $\lambda$, is the only difference between $L^{2}$ and $L^{*}$ the word $\lambda$ ? ( $L^{2}$ is the language $L L-L$ concatenated with itself).
2. For each of the problems below, give a regular expression which only accepts the following. Assume $\Sigma=\left\{\begin{array}{ll}a & b\end{array}\right\}$
(a) All strings that begin and end with the same letter
(b) All strings in which the total number of $a$ 's is divisible by 3
(c) All strings that end in a double letter
3. Show the following pairs of regular expressions define the same language
(a) $\left((\mathbf{a}+\mathbf{b b})^{*} \mathbf{a a}\right)^{*}$ and $\lambda+(\mathbf{a}+\mathbf{b b})^{*} \mathbf{a a}$
(b) $(\mathbf{a b})^{*} \mathbf{a} \quad$ and $\mathbf{a}(\mathrm{ba})^{*}$
(c) $\left(\mathbf{a}^{*} \mathbf{b b b}\right)^{*} \mathbf{a}^{*} \quad$ and $\mathbf{a}^{*}\left(\mathbf{b b b a}^{*}\right)^{*}$
4. Describe (in English phrases) the languages associated with the following regular expressions
(a) $(\mathbf{a}+\mathbf{b})^{*} a(\lambda+b b b b)$
(b) $\left(\mathrm{a}(\mathrm{aa})^{*} \mathrm{~b}(\mathrm{bb})^{*}\right)^{*}$
(c) $((\mathbf{a}+\mathrm{b}) \mathbf{a})^{*}$
